

XVIII. *Revision of the Notonectidæ. Part I. Introduction, and Systematic Revision of the genus Notonecta.* By G. W. KIRKALDY.

[Read Oct. 6th, 1897.]

THE genus *Notonecta* was erected by Linnæus in 1758,<sup>1</sup> and contained three species, *N. glauca*, *N. striata*, and *N. minutissima*. In 1762 Geoffroy<sup>2</sup> proposed the genus *Corixa* for *N. striata*, which, however, was not (or was only in small part) *striata* of Linnæus; nevertheless the latter belongs to Geoffroy's genus, and the type is therefore limited to the two other original species. In 1794 Fabricius<sup>3</sup> enlarged the scope<sup>4</sup> of his genus *Sigara* to admit a new species, *minuta* (= *N. minutissima*, L.), thus indirectly but actually establishing *N. glauca* as the type of the genus *Notonecta*. In 1818 Leach published his "Classification of Notonectides"<sup>5</sup> with a new genus *Plea* (type *Notonecta minutissima*, Fourcr.), and in the following year, C. R. Sahlberg's "Observationes quasdam Historiam Notonectidum . . . illustrantes," appeared, in which Leach's conclusions were closely followed. Spinola completed his "Essai" in 1837, proposing two new genera, viz. :—*Anisops* for *N. nivea* and *Enithares* for *N. indica*, L., and a new species, *E. brasiliensis*.<sup>6</sup> In 1844 Fieber published his "Entomologische Monographien,"<sup>7</sup> including a monograph (pp. 294–7) of the genus *Ploa* (*Plea*), and seven years later appeared his "Rhynchotographieen"<sup>8</sup> upon pp. 469–486, of which (usually quoted from the separate copies, pp. 45–62) were described all the species known to him of the other genera, *Bothronotus* being arbitrarily substituted for *Enithares*. Unfortunately the latter work has been rather a hindrance than a help, as the descriptions are not based upon structural characters,

<sup>1</sup> Syst. Nat. Ed., x., p. 439.

<sup>2</sup> Hist. abrég. Ins., i., p. 475.

<sup>3</sup> Ent. Syst., iv., p. 60.

<sup>4</sup> Kirk., 1897, Ent., p. 260.

<sup>5</sup> Trans. Linn. Soc., xii., pp. 10–18.

<sup>6</sup> I am not aware that any author has indicated a type for this genus, and therefore now set apart *E. indica* for that purpose.

<sup>7</sup> Abh. K. böhm. Ges. Wiss. (5) iii.

<sup>8</sup> Abh. K. böhm. Ges. Wiss. (5) vii.

whereas, in the Notonectidæ at least, any other method is of little avail; moreover, the majority of the types are lost, and it is apparently impossible to appropriate the descriptions with any degree of certainty.

Since then, little has been done; a few species have been described at intervals, and three new genera, viz.: — *Antipalocoris*, Scott,<sup>1</sup> *Martarega*, B. White,<sup>2</sup> and *Signoretiella*, Berg,<sup>3</sup> each with a single species.

Before proceeding, I must express my thanks to the friends and correspondents who have lent or given me types or other specimens, and otherwise assisted me; as these include nearly all the entomologists who are interested in Rhynchota, it is impossible even to enumerate them. I am particularly indebted to Professors Uhler and Montandon, to M. Maurice Noualhier and Mr. Edward Saunders; also to the directors and assistants of the British, Budapesth, Hamburg, Hope (Oxford), Paris, Stockholm, and Vienna Museums.

#### FAM. NOTONECTIDÆ.

*Rostrum 3-4 segmentatum; antennæ 4-segmentatæ; pronoti margine postica pedes antici inserti; scutellum magnum.*

The insertion of the anterior pedes on the posterior margin of the pronotum at once separates the Notonectidæ and Corixidæ from all the other aquatic paggiopodous Rhynchota, in which the insertion is on or near the anterior margin; the visibility and size of the scutellum distinguishes the Notonectidæ from all the Corixidæ, except *Diaprepocoris*, Kirk., from which, however (and from the other Corixidæ), they are readily differentiated by the three- to four-segmentate rostrum; the anterior tarsi, moreover, are quite differently shaped in these two families, being simple and raptorial in Notonectidæ, while in Corixidæ they are more or less dilated and spoon-shaped.

Two subfamilies are embraced:—

- 1 (2) Tibiæ posticæ tarsique postici ciliati; venter carinatus, ciliatus; rostrum 4-segmentatum; oculi permagni, conspicui . . . . NOTONECTINÆ.

<sup>1</sup> 1872, in Marshall, Ent. Mo. Mag., viii., p. 244.

<sup>2</sup> 1879, Trans. Ent. Soc. Lond., p. 271.

<sup>3</sup> 1883, An. S. Cient. Argent., xvi., p. 122.

- 2 (1) Tibiæ posticæ tarsique postici non ciliati; venter nec carinatus nec ciliatus; rostrum 3-segmentatum; oculi parvi, vix conspicui . . . . PLEIN.E.

## Subfam. NOTONECTINÆ.

- A Oculi ad basin non contigui; femora postica non attingentia hemielytrorum apicem.
- a (b) Pronotum non transversissimum; alæ adsunt, aræ hemielytrorum distinctæ.
- 1 (2) Antennarum segmentum ultimum penultimo multo brevius; tarsi postici unguiculis destituti.
- Notonecta*, L.
- 2 (1) Antennarum segmentum ultimum penultimo multo longius; tarsi postici unguiculis instructi.
- Anisops*, Spin.
- b (a) Pronotum transversissimum; antennarum segmenta ultimum penultimumque subæqualia; tarsi postici unguiculis longis instructi.
- 1 (2) Hemielytrorum aræ distinctæ; alæ adsunt; tarsi intermedii bisegmentati. . . . *Enithares*, Spin.
- 2 (1) Hemielytrorum aræ nullæ seu subobsoletæ; alæ desunt; tarsi intermedii unisegmentati.
- Martorega*, B. White.
- A A Oculi ad basin contigui; hemielytrorum aræ nullæ seu indistinctæ; alæ nullæ; pronotum transversissimum.
- 1 (2) Femora postica ultra hemielytrorum apicem extensa; antennarum segmentum ultimum penultimo multo longius; tarsi postici unguiculis brevissimis instructi . . . . *Antipalocoris*, Scott.
- 2 (1) Femora postica non attingentia hemielytrorum apicem; antennarum segmentum ultimum penultimo multo brevius; (? tarsi postici unguiculis destituti).
- Signoretiella*, Berg.

I have seen no satisfactory account of the structure of the head in this family; and as it is very obscure in the mature imago, and can be worked out only from a comparative study of the larval stages, novel but provisional terms have been employed in describing it. That portion of the head which is apparent from a dorsal aspect is named the *notocephalon*; it is more or less constricted close to the base, this constriction, here termed the

*synthlipsis*, being of great convenience for diagnostic purposes. The imaginary anterior margin of the notocephalon is called the *vertex*. The junction of the metathorax and abdomen has been taken as the centre of the insect. This will explain why the tip of the scutellum is called its "base," and why the "third side" is termed its "apical margin."

HEAD. *Antipalocoris* and *Signoretiella* are at once recognised by the contiguity of the eyes basally; in *Anisops* the notocephalon is very narrow, in the other genera wider. In *Anisops* the labrum attains to the apex of the second rostral segment, in *Notonecta*, *Enithares*, and *Martarega* to about the centre of that segment; Berg and Scott do not mention it. The ultimate and penultimate antennal segments are subequal in *Enithares* and *Martarega*; the ultimate is much the longer in *Anisops* and *Antipalocoris*, and much the shorter in *Notonecta* and *Signoretiella*.<sup>\*</sup> The scutellum in *Notonecta* is large and almost equal in length to the metanotum, except in *N. mexicana*, where it is only about half its length; in *Enithares* and *Martarega* it is about half, and in *Anisops* and *Antipalocoris* about one-third the length of the metanotum. Berg does not mention it in *Signoretiella*.

The HEMIELYTRA are divided into clavus, corium, and membrane in *Notonecta*, *Enithares*, and *Anisops*, and these genera are furnished with alæ, which are wanting in the other genera, in which also the hemielytra are not or at least very obsoletely divided into areas.

PEDES. The length of the pedes in *Antipalocoris* readily distinguishes that genus, the apices of the

---

<sup>\*</sup> I regret that I cannot altogether agree with Berg's account of the antennal segments (An. S. Cient. Argent., xvi., p. 122). He believes that the antennæ in *Notonecta* and *Signoretiella* have five segments. I am unable to speak with regard to the latter genus, but judging from preparations in glycerine jelly of four species of the former, examined under a compound microscope, the third segment of Berg appears to be only a muscular articulation between the true second and third segments. The basal segment, which Berg thinks may be an antenniferous tubercle (*tubérculo antenar*), seems in structure, texture, and method of articulation, to be a true antennal segment.

posterior femora extending beyond the apex of the hemielytra; to which they do not attain in the other genera.

NOTONECTA, L.

Linn., 1758, Syst. Nat., Ed. x., p. 439; Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., pp. 205 and 472; Flor, 1860, Rhynch. Livl., i., p. 766.

TYPE. *N. glauca*, L.; Fabr., 1794, Ent. Syst., iv., p. 57.

Flor has given such a masterly description of the genus that it is not necessary here to do more than indicate the leading features; to comprehend the exotic species it is necessary, however, to modify slightly Flor's description of the head and eyes. Fieber's figures (*l. c.*, pl. iii., D) are admirable except that the pronotum is too long in proportion to its breadth, the posterior pedes are represented with long unguiculi, of which they are really devoid, and the alar neuration is not quite correct in its proportions.

To the characters given previously, it may be added that the intermediate ambulacra are not nearly contiguous (as they are in *Enithares*) and the posterior ambulacra are practically contiguous, distinguishing the genus at once from *Anisops*; the median ventral carina of the abdomen is thickly pilose, as are the lateral margins, thus forming a waterproof covered way over the "gutters," which lie, one on each side of the carina, for the conveyance of air. The junctures of the connexival ventral segments are always covered with short thick hair, and the scutellum and hemielytra are generally clothed with short golden yellow pubescence. The sexes are almost indistinguishable in size, form, colour and general appearance, though, of course, the female, when full of mature ova, is dilated more than at other times. They can be very readily separated by an examination of the last three or four abdominal ventral segments. These are horizontal in the female, rounded and anteriorly excavated in the male.

*Notonecta* is a genus of which the species are singularly lacking in specific characters suitable for diagnosis: and the analytical table has been based principally upon the structure of the notocephalon and pronotum. With

the exception of certain minor differences in the ventral abdominal segments and the proportions of the scutellum, I am unacquainted with any other such characters; while several structural features, largely employed for diagnostic purposes in other groups of Rhynchota, appear to be valueless in *Notonecta*. The sculpture of the head and pronotum, and the colour and pattern of the hemielytra are not constant, although a more or less bright crimson or scarlet dorsum abdominis seems to be characteristic of *N. insulata*, W. Kirb., and *N. montezuma*, Kirk., and a rich black and yellow metanotum and dorsum abdominis of *N. glauca*, var. *maculata*, Fabr.

Unless otherwise mentioned, the scutellum, metanotum and sterna are black, the sternal hairtufts varying from bronze-yellow to dark bronze-brown.

Melanochroism and leucochroism are more marked in this genus than in any other of the Rhynchota with which I am acquainted. I have examined melanochroic individuals of six species, viz.: *N. glauca* (*nigra* and *marginata*), *N. undulata*, *N. americana*, *N. variabilis*, *N. lactitans* (*stygica*), and *N. mexicana*, while certain examples of *N. irrorata*, *N. shooterii*, *N. triquittata* and *N. insulata* have almost a right to the name.

*N. lutea* has been treated as a separate species; but it may perhaps be regarded more correctly as a nearly stable leucochroic race of *N. glauca*; an African form of *N. glauca*, var. *maculata*, is generally concolorous, dark luteous. Similarly coloured (though much lighter) forms occur commonly in *N. undulata*, *N. americana*, *N. shooterii*, and probably in other species.

A noteworthy fact is that, with the exception of *N. undulata*, *N. americana*, one or two *N. shooterii* and the luteous form of *maculata* (which, strictly speaking, is not leucochroic), all the luteous specimens, some forty or fifty, that I have seen, have unequal-lobed membranes. Dr. Bergroth kindly pointed out this peculiarity in *N. lutea*; I was at first inclined to regard it as a specific character, but found this view to be premature on meeting with luteous examples of *N. shooterii* (*q.v.*), some with ordinary, some with semi-developed lobes.

Unless otherwise indicated, it may be assumed that the head, pronotum, and pedes are greenish testaceous.

varying from almost stramineous to full rich green; after death the green fades, and these parts acquire a sordid stramineous or even brown hue. The apical rostral segment appears to be constantly piceous.

Great hopes were entertained by me that the ♂ genitalia would furnish a reliable diagnostic character, but in the few species (*N. glauca*, *N. lutea*, *N. irrorata* and *N. undulata*), of which suitable material was available, these hopes have not been realized.

#### Geographical Distribution.

The genus *Notonecta* is distributed practically over the world, though its home seems to be in North America; it is very difficult to define any special regions, as waterbugs admittedly have no respect for such limitations. *N. glauca* is distributed throughout Europe, N. Africa, Siberia, Persia, N. India, and probably Brazil; the allied species, *N. undulata*, *N. americana* and *N. variabilis* occupy practically the whole of America, while *N. mexicana* and *N. insulata* occur plentifully in North and Central America and in the northern states of South America; *N. montandoni* has been found in China and Burma.

Only one species, *N. lactitans*, has been found as yet in Africa south of the Sahara, but it extends from Guinea to the Cape of Good Hope.\*

Throughout this paper the localities derived from specimens seen by myself are alone given, unless otherwise stated.

#### SPECIERUM TABULA.

- 1 (2) Pronoti basis latitudo pronoti longitudine duplo atque dimidio major; metanotum scutello fere duplo longius.  
(America bor. et merid.) 1 *mexicana*, Am. Serv.
- 2 (1) Pronoti basis latitudo pronoti longitudine duplo atque dimidio minor (plerumque fere duplo major); metanotum scutello paullo longius.
- 3 (4) Vertex synthlipsi amplius quinquies latior.  
(America bor.) 11 *uhleri*, Kirk.

\* I shall be greatly indebted to any South American or South African entomologist who will send me the *Notonecta* of his country.

- 4 (3) Vertex synthlipsi minus quinques latior.
- 5 (10) Notocephali margines laterales subrectæ atque fere parallele.
- 6 (7) Corporis longitudo haud minus quam 13 mm. ; abdominis dorsum plus minus coccineum.  
(America bor.) 3 *insulata*, W. Kirb.
- 7 (6) Corporis longitudo minus quam 13 mm. ; abdominis dorsum haud coccineum.
- 8 (9) Forma longiuscula, tenuis. (Africa merid.) 5 *lactitans*, Kirk.
- 9 (8) Forma breviuscula, robusta.  
(America bor. et merid.) 7 *americana*, Fabr.
- 10 (5) Notocephali margines laterales plus minus curvatæ, necquaquam parallele.
- 11 (22) Vertex synthlipsi amplius duplo atque dimidio latior.
- 12 (19) Species magnæ, robustæ ; amplius 12.5 mm. longitudine.
- 13 (18) Vertex synthlipsi triplo (aut minus) latior.
- 14 (15) Caput magnum, vertex quam oculi alteriusutrius latitudo latior . . . (China, Birmania) 14 *montandoni*, Kirk.
- 15 (14) Caput mediocre ; vertex quam oculi alteriusutrius latitudo nec latior.
- 16 (17) Caput brevius, oculi majores ; pronoti margines laterales subrectæ . . . (America bor.) 15 *irrorata*, Uhl.
- 17 (16) Caput longius, oculi minores ; pronoti margines laterales mediatim retrorsum subito ampliatæ.  
(Japonia) 13 *triguttata*, Motsch.
- 18 (13) Vertex synthlipsi fere quadruplo latior.  
(China) 12 *chinensis*, Fallou
- 19 (12) Species parvæ ; minus 12 mm. longitudine.
- 20 (21) Pronotum duplo (aut fere duplo) latius quam longius.  
(America bor. et merid.) 10 *variabilis*, Fieb.
- 21 (20) Pronotum duplo atque triens latius quam longius.  
(America merid.) 9 *bifasciata*, Guér.
- 22 (11) Vertex synthlipsi minus duplo atque dimidio latior.
- 23 (24-25) Notocephali margines laterales curvatæ sed non sinuatæ (vertex atque synthlipsis subæquales) ; abdominis dorsum haud coccineum.  
(America merid.) 4 *shooterii*, Uhl.
- 24 (25-23) Notocephali margines laterales subrectæ ; abdominis dorsum subcoccineum.  
(America centr.) 2 *montezuma*, Kirk.



- 25 (23-24) *Notocephali* margines laterales curvatæ et sinuatæ ; abdominis dorsum haud coccineum.
- 26 (31) Species magnæ, robustæ.
- 27 (28) Posterius ampliata ; membranæ lobi inæquales.  
(Europa) 18 *lutea*, Müll.
- 28 (27) Posterius haud ampliata ; membranæ lobi subæquales.
- 29 (30) Caput, pronotum, scutellum nitida nigra (hemelytra rubronigra) . . . . (Brasilia) 17 *nigra*, Fieb.
- 30 (29) Caput, pronotum, scutellum non omnino nigra.  
(Regiones palæarctica tota, orientalis in parte)  
16 *glauca*, L.
- 31 (26) Species parvæ, subrobustæ.
- 32 (33) Pronoti basis subrecta.  
(America bor. et merid.) 8 *undulata*, Say.
- 33 (32) Pronoti basis aperte concavocurvata.  
(Australia) 6 *handlirschi*, Kirk.

1. *Notonecta mexicana*, Am. Serv.

- Notonecta mexicana*, Am. et Serv., 1843, Hist. nat. Ins. Hém., p. 453, pl. viii., fig. 7; Herr.-Schäff., 1853, Wanz. Ins., ix., p. 43, pl. 294, fig. 903; Uhl., 1886, Checklist Hem.-Het. North Amer., p. 28.
- N. klugii*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 474.

*Head* narrow at base, parallel for a short space, then sinuately diverging ; vertex from three to four and a-half times as wide as synthlipsis. *Pronotum* very transverse, about two and a-half times wider than long, lateral margins slightly sinuate, humeral margins gently and elongately curved, posterior margin not sinuate ; humeral angles acute, accentuated. *Meta-notum* not quite half as long again as scutellum, black (dark vars.) or violet-brown, margined with luteous (pale vars.). *Hemelytra* varying in colour, membrane-lobes subequal. *Alæ* semitransparent, smoky, nervures brown (pale vars.), or semitransparent smoky black, nervures blackish-brown (dark vars.). *Abdominis dorsum* black (dark vars.), or rufolutescent with paler genital segments (pale vars.). *Abdominis venter* varying from black to testaceous.

Long. 11-14 mm., lat. 4.5-4.8 mm.

*Hab.* AMERICA: Western United States ; Mexico ; Costa Rica ; Colombia.

The types of *N. mexicana* and *N. klugii* appear to be lost.

*Varieties.*

The hemielytra are usually rich scarlet, with black membrane, but the latter hue often extends beyond the apical margins of the clavus and corium; the scarlet also varies much in shade, graduating in one direction to pale greenish-white through pale yellow, pale olive-green, deep yellow, orange and pinkish, and in the other through crimson and violet-red to deep violet-black, though, in the last, the sutures of the hemielytral divisions are usually narrowly violet-red; in some specimens the apex of the corium is black, from the base of the membrane to the margins of the hemielytra in a straight line, and the rest of the hemielytra are rich crimson. The hemielytra are rarely maculate, occasionally the centre of the clavocorial suture has a more or less pronounced black smudge about the centre. It may be convenient to propose the varietal names *ceres* for the pale coloured forms and *hades* for the southern violet-black race. Herrich-Schäffer (*l. c.*, p. 43) notes a variety with a large ochreous central stripe on the scutellum, while Fieber (*l. c.*, p. 475) describes among the varieties with red hemielytra: (1) "Schild schmutzig-gelb mit braunem Grund," and (2) "Schild braun, mit gelblichem Rand"—these three varieties I have not seen.

The crimson forms are well distributed over the Western United States, Mexico, and Colombia; the pale forms I have seen from Lower California, Mexico, Costa Rica, and Colombia; the melanochroic forms are much rarer and more local, though occurring in the same localities as the pale forms.

This is the most aberrant species of *Notonecta*, differing from all the others in the proportions of the pronotum and scutellum; it is wider in proportion to its length, and the humeral angles are more accentuated. It shows affinities in several details to *Enithares*, and is perhaps nearer in structure to the primitive Notonectid than any other existing species of its genus.

## 2. *Notonecta montezuma*, sp. n.

*Head* narrow at base, similar to that of *N. mexicana*, notoccephalic lateral margins fairly straight, diverging from the base, vertex two and a-half to three times as wide as synthlipsis.

*Hemelytra* orange-red, suffused (especially marginally) with crimson, and sparingly and irregularly marked with black; membrane bluish-black, apex brownish-black, lobes subequal. *Pedes*: coxæ brownish-black, intermediate tibial spur small, rather blunt. *Abdominis dorsum*: segment 1 black, 2 sordid testaceous, suffused with crimson and margined with black. *Venter* black.

Long. 13·5–14 mm., lat. 4·7–5 mm.

*Hab.* AMERICA, W. Mexico, ♂, ♀. (*Hope Mus. Oxford.*)

“Nord de l’Inde” [? error] (*Paris Mus.*).

TYPE. ♂. *Hope Mus.*

Very similar to, and perhaps an aberration from, *N. insulata*, but differing by the structure of the head. Not unlike *N. mexicana*, but larger, more elongate, and differing by the pronotal structure.

### 3. *Notonecta insulata*, W. Kirb.

*Notonecta insulata*, W. Kirb., 1837, in Richardson’s Faun. Bor. Amer. Ins., p. 235 [reprint 1878, *Canad. Ent.*, x., p. 216]; Uhl. 1886, *Checkl.*, p. 28.

*N. impressa*, Fieb., 1851, *Abh. böhm. Ges. Wiss.* (5) vii., p. 475; Uhl., 1886, *Checkl.*, p. 28. *Syn. nov.*

*N. rugosa*, Fieb., 1851, *l. c.*, p. 476.

? *N. fabricii*, Towns., 1891, *Pr. Ent. Soc. Wash.*, ii., p. 56 (*nec* Fieb.).

*Head*: notocephalic lateral margins fairly straight and nearly parallel, very slightly constricted near the base; vertex little wider than synthlipsis, which is about one-fourth less than the width of the base of the eye. Lateral and humeral margins of the pronotum sinuate. *Scutellum* varying slightly in length, but occasionally reaching and usually nearly reaching the base of the metanotum, black [Fieber, in *N. rugosa*, records two varieties (*cordigera* and *basalis*) with yellowish scutellum, but I have not seen them]. *Hemelytra* variable in pattern and colour, the principal variations being:—

1. Fusco-flavous (or sordid testaceous), with a faint blackish spot or streak here and there; indistinguishable from some forms of the hemelytra in *N. glaucu* [? *N. fabricii*, Towns.].

2. Rufous; the base of the membrane, an irregular blotch

on the corium and one at the base thereof, black; apex of membrane testaceous.

3. Apical half of hemielytra black, basal half orange-brown, or deep rich crimson-red (in some individuals assuming almost a purple hue), which may be more or less clouded with black. [? *N. impressa*, Fieb.]

4. Black; except the basal half of clavus and a small spot near the submargin (about the centre) of the exocorium, which are roseo-testaceous, and a scarlet irregular (usually pentagonal) spot on the apical margin of the corium; the exocorium spotted regularly with brownish crimson; apex of membrane sordid testaceous.

5. *When living*, "clear ivory white, with irregular dark spots on the hemielytra, and the large spots at base of corium . . . conspicuous, greenish white" (Uhler *in litt.*); but *after death*, much tarnished, the white changing into pale dirty bronze green.

*Alæ*: basal nervures crimson, the others yellow brown. *Pedes*: coxæ black, intermediate tibial spur small, slender, not tipped with black. *Abdom. dorsum*: segment 1 black, 2-6 brilliant scarlet, 7-8 reddish-testaceous.

*Abd. venter* black, connexivum and central carina green.

In all five varieties, the membrane lobes are subequal.

The ordinary pale forms may be known as var. *odara*, the fifth variety as var. *geala*, while Fieber's "*impressa*" may be retained as a varietal name for the crimson and black forms.

The disposition of the scarlet colour of the dorsum abdominis, and its actual shade, vary greatly: in some examples the second segment is suffused with black, the third to the sixth being more or less scarlet, while in others only the central parts of these segments are thus coloured; the hue varies from orange-red to deep crimson. It is curious that this colour has not, as I believe, been previously noted.

Long. 13-15 mm., lat. 4.9-5 mm.

TYPES. ?

*Hab.* AMERICA. Prof. Uhler (1875, Wheeler's Exped., xii., p. 841) writes: "It seems to extend entirely across the continent [*i.e.*, of N. America], north of the fortieth parallel, and on the Pacific side extends as far south as San Francisco;" in a recent letter he adds: "distributed from the upland cold water of Maryland all the way north to British America, and across Canada to

near the Pacific Coast, down which it spreads to Lower California and the highlands of Mexico." It seems, further (from what Prof. Uhler writes) that while *N. undulata*, Say (*q.v.*), is a *Notonecta* of the plains more especially, in warm ponds and streams, *N. insulata* is an insect rather of the hills, in cold pools. "The pond [*i.e.*, where *N. undulata* was abundant] is exposed to the sun's rays, and the water becomes mostly warm. At the western end, however, the pond is supplied with cold, spring water, and at that end lives the *Notonecta insulata*." And again: "It seems to belong to the foot-hills and high plateaux of the Rocky Mountains west of the Mackenzie River; but it was not brought in from the plains." From the specimens I have examined, the very ruddy examples seem to occur principally in California, Colorado and Mexico, while the paler and rather larger forms come more frequently from the Eastern States. Fieber (*l. c.*) records *N. rugosa* from Brazil.

Very like *N. glauca*, but at once distinguished by the structure of the head. There are (as in *N. glauca*) two somewhat dissimilar forms of eye in this species. Usually the notocephalon is short and the eyes are small, curving away from the vertex suddenly; occasionally, however (and especially in var. *geala*), the eyes are more quadri-lateral and larger, and the notocephalon is longer.

In Signoret's collection there is a specimen labelled "*N. rugosa*" by him, from Canada, which I cannot satisfactorily place in any species. It has the cephalic structure of *N. lutea*, Müll., but is rather less robust posteriorly and has the ruddy dorsum always present in *N. insulata*; the membrane lobes are unequal, as is usual in leucochroic individuals, and the hemielytra are greyish yellow-green. It seems best, till further evidence is obtainable, to regard it as an aberration from the present species.

#### 4. *Notonecta lactitans*, Kirk.

*Notonecta lactitans*, Kirk., 1897, Ann. Mag. N. H. (6),  
xx., p. 58.

*Head*: notocephalic lateral margins almost parallel, vertex about a fourth wider than synthipsis; base of the eye about half as wide again as synthipsis. *Pronotal* humeral margin well sepa-

rated; *scutellum* nearly as long as metanotum. *Hemelytra*: clavus and corium yellowish-brown, with a broad dark-brown band along the base of the latter, and sometimes with a narrower blackish-brown line along the scutellar and sutural margins of the clavus; exterior margin of exocorium narrowly pale. *Alar* nervures yellowish-brown. *Pedes*: intermediate tibial spur small and rather blunt. *Abdominis dorsum* shining black, genital segments blackish-fuscous margined with green. *Venter* black.

Long. 12-12.5 mm., lat. pronot. 3.4-4 mm.

*Hab.* AFRICA: Guinea (*my coll.*); Gaboon (*Vienna Mus.*), Cape of Good Hope (*Paris Mus.*).

TYPE. Coll. mea.

This species has no very close affinities with any other *Notonecta*; its long and slender form and rather stout hemelytra will at once separate it, while the structure of the head places it near *N. insulata*.

Var. nov. *stygica*.

Smaller and rather more slender; *hemelytra* black, exterior margins of clavus broadly dark stramineous and interior half of apical margin of corium stramineous; membrane sordid white, except the smoky basal part of the apex of the exterior lobe.

*Hab.* ? AFRICA (*British Mus.*).

##### 5. *Notonecta shooterii*, Uhl.

*Notonecta shooterii*, Uhl., 1894, Pr. Calif. Ac. Sci. (2), iv., p. 292.

*Head* short, notocephalic lateral margins slightly diverging from the base and slightly converging towards the vertex, which is about one-third wider than the synthlipsis. *Pronotum* large, rather longer in proportion to its width than in the other species, lateral and humeral margins sinuate. *Scutellum* small, nearly one-third shorter than the metanotum; black, base purple-brown. *Sterna* sordid rufotestaceous, hair-tufts black. *Hemelytra* black; clavus (apex excepted) dull ivory-white, corium more or less concolorous, forming with the clavus a blotch of varying extent, and usually with a whitish spot along the apical margin, the claval and corial markings very similarly disposed to those of *N. triguttata*; apex of membrane smoky. The hemelytra vary, however, very much, being quite violet-black in some individuals (*melana*, var. nov.), while in others they are concolorous pale luteous. Membrane-

lobes always subequal in ordinary forms; generally unequal in the leucochroic varieties (*ochrothoe*, var. nov.), and rarely subequal (*tearca*, var. nov.). *Alar* nervures rich brown. *Pedes*: intermediate coxæ black, tibial spur small, rather blunt. *Abdominis dorsum*: segment 1 black, 2-5 violet-brown (the fifth apically black), 6 blackish, genital segments greenish-testaceous, all the segments more or less dull blackish laterally. *Venter* varying from green to black, carina and cilia black.

Long. 8-13 mm.,\* lat. pron. 4-4.7 mm.

TYPE. Uhler coll.

*Hab.* AMERICA, "exclusively Western" (*Uhler in litt.*); California (*Uhler's and my coll.*); Mexico (*Paris and Stockholm Mus., Noualhier coll.*); Colombia (*Paris Mus.*). Var. *melana*: Mexico (*Noualhier coll.*).

This species cannot be mistaken for any other; the small, short head, the flat eyes with the anterior margins receding much as in typical *N. insulata*, the robust pronotum and the structure of the notocéphalon at once distinguish it.

Allusion has already been made to what I suppose to be concolorous varieties of this species. There are, as indicated above, two forms; those with subequal membrane-lobes, differing from the type only in the colour, which is (except the eyes, unguiculi, segment-junctions, &c.) entirely pale luteous. This form I have seen only from Mexico (in the Stockholm Mus. and in the Paris Mus., where it was labelled "*americana*," by Fallou). The other forms, also luteous, differ from the type in that they have unequal (both in width and length) membrane-lobes, and are much commoner (being noted from Mexico and Colombia). They furthermore differ among themselves in the shape of the pronotum. In nearly every case the lateral margins are almost perpendicular to the apical and basal margins and parallel to one another, while the humeral margins are not separable from the posterior margin. There are, however, gradations to the usual shape. Prof. Uhler informs me that in the U.S. National Museum there is a specimen of this species pure ivory-white, and the above-mentioned luteous examples are probably this colour when fresh.

---

\* The smallest length given is that recorded by Uhler (*l. c.*, p. 293), and 10.5 mm. is the smallest I have examined.

Here should probably be referred two handsome *Notonectæ* from Guanajuato in Mexico (*Dugès in Mus. Paris*).

*Pronotum*: humeral margins longer and more sinuate than in type. *Scutellum* bluish-black, thickly furnished with short white pubescence. *Hemelytra* bluish-black, a pinkish-brown band along the basal half of the claval exterior margin and a similarly coloured spot on the basal third of the corium; apical half of membrane same colour.

Long. 11 mm., lat. 4.2 mm.

This may, however, prove to be a distinct species.

#### 6. *Notonecta handlirschi*, sp. n.

*Head* similar in shape to *N. lutea*, Müll., vertex not quite as wide as synthlipsis, notocephalic lateral margins fairly straight; base of an eye about half as wide again as synthlipsis. *Pronotum* similar in general shape to that of *N. glauca*, L., but posterior margin sensibly concave. *Hemelytra*: clavus and claval margin of corium dark castaneous, rest of corium and membrane (except apical margin) lurid; exocorium anteriorly lurid, posteriorly castaneous. *Pedes*: intermediate tibial spur small and blunt. *Metanotum* and *dorsum abdominis* rufotestaceous. Whole ventral surface black.

Long. 10-10.5 mm., lat. pron. 3.5-4 mm.

*Hab.* AUSTRALIA ("Post., A. Fischer, 1878," *Vienna Mus.*).

Something like *N. americana*, Fabr., but with the colour and pattern very obscure. I have great pleasure in dedicating this species, the first true *Notonecta* from Australia, to Dr. Handlirsch of the Vienna Museum.

#### 7. *Notonecta americana*, Fabr.

*Notonecta americana*, Fabr., 1775, *Syst. Ent.*, p. 690, &c.; Ol., 1811, *Enc. Méth.*, viii., p. 389; Uhl., 1886, *Checkl.*, p. 28; 1894, *P.Z.S. Lond.*, p. 222.

*Head* rather large, notocephalic lateral margins straight, not very divergent from the base; vertex varying from one and a-half to twice as wide as the synthlipsis. *Scutellum* rather shorter than



in *N. undulata*, Say. *Hemicytra* variable: (1) fulvous or dark stramineous, with a broad black fascia near the apex, occupying the basal two-thirds of the membrane, and the apex of the corium. This seems to be the original *N. americana*, Fabr. (2) Varying from bluish-black to violet-brown; the corial margins of the clavus, and a broad irregular blotch about the middle of the corium, fulvous or dark stramineous. Otherwise like *N. undulata*, Say.

Long. 10-11 mm., lat. 3.5-3.6 mm.

*Hab.* C. and S. AMERICA, Mexico (*Paris Mus.*; *Noualhier and my colls.*); Chili, Valdivia (*Hamburg Mus.*); Cuba (*Paris Mus.*; *my coll.*). It probably extends over Mexico, the Antilles, and the greater part of S. America.

This species has been compared with *N. undulata*, Say, instead of the reverse, as, through the kindness of Prof. Uhler, I have had plenty of fresh material in the latter species, whilst in the present species I have only seen two fresh specimens (from Prof. Uhler). Fabricius says "alis nigris"—but the few examples I have been able to examine have transparent, colourless alæ with nervures coloured as in *N. undulata*, though Prof. Uhler writes me that he formerly possessed at least two specimens with the exterior margin of the alæ black. Hoping that the Copenhagen Museum might possess Fabricius's missing type, one of the above examples was sent to Dr. Meinert, who wrote that he had compared it and found it to accord with a specimen labelled "*N. americana*" which was undoubtedly seen by Fabricius, though it is not the type. This and the two following species Prof. Uhler considers as most probably conspecific, and it is probable that future researches will show this to be so; for the present, however, it seems best to regard them as distinct. In his *N. americana* Fabricius probably also included *N. undulata*, Fieber's *N. variabilis* undoubtedly included *N. americana* and *N. undulata*, while Say's *N. undulata* included *N. americana* and probably *N. variabilis*; and the references given to all three species must therefore be taken as the best possible under the circumstances. *N. americana*, Herr.-Schäff., is clearly *N. undulata*, from the figure, and *N. variabilis*, Guér., is the same species, according to the specimens labelled by him in his collection (*Paris Mus.*).

8. *Notonecta undulata*, Say.

- Notonecta undulata*, Say, ? 1832, Descr., Het. Hem. N.-Am., p. 38; Complete Writ., 1869, i., p. 368; Uhl., 1875, Bull. U.S. Geol. Surv. (2) v., p. 239, pl. 21, fig. 33; 1886, Checkl., p. 28; Comst., 1888, Introd. Ent., i., p. 186, fig. 157; Weed, 1889, Bull. Ohio Agr. Sta., Techn. ser., i., p. 12, pl. ii., fig. 3.
- N. americana*, Gmel., 1789, in Linn. Syst. Nat., ed. xiii., p. 2118; Herr.-Schäff., 1853, Wanz. Ins., ix., p. 44, pl. 294, fig. 902 (*nec* Fabr.), *syn. nov.*
- N. punctata*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5) vii., p. 476; Uhl., 1886, Checkl., p. 28, *syn. nov.*
- N. variabilis*, Fieb., 1851, *l. c.*, 477 (*in part*); Guér., 1856, in Ramon de la Sagra's Cuba, Hist. Nat., vii., p. 176.
- N. virescens*, Blanch., 1852, in Gay's Chile, Zool., vii., p. 233; Atlas Zool. Ins. hémipt., pl. ii., fig. 16, *syn. nov.*
- N. pallipes*, Leth., 1881, Ann. Soc. Ent. Belge, xxv., p. 13 (*nec* Fabr.).

*Head* diverging curvedly (varying in degree) from the synthipsis, which is not quite two and a-half times less wide than the vertex. *Pronotum* very similar to that of *N. glauca*, L., but the humeral margins as a rule not distinct. *Scutellum* not quite one-fourth shorter than the metanotum, varying in colour from pale luteous to black, with divers intermediate arrangements of the two colours; similar hemielytral markings occurring with dissimilarly coloured scutella and vice-versa. *Metanotum* varying from luteous to black, with three or more dark castaneous stripes, scutellar margin luteous. *Hemielytra* exceedingly variable, giving rise to a number of well-marked varieties, though these are linked together by intermediate forms.

Var. 1, *maculata*, Fieb. Pure moonlight colour (or occasionally very pale greenish-yellow), either immaculate or with a rich sienna-brown spot at the base of the membrane. *Scutellum*, *metanotum*, and abdominal segments pure golden-yellow.

This is also (according to the specimens labelled in his handwriting, from Lethierry's collection now in the collection of M. Maurice Noualhier and Prof. Montandon) *N. pallipes*, Leth.

Var. 2, *undulata*, Say. The common variety, varying from pure ivory-white to pale luteous or stramineous, with an undulatory subhorizontal blackish fascia, which is sometimes a mere thin line, but generally a broad band extending between the exterior lateral margins of the hemielytra, practically covering the base of the membrane, exteriorly encroaching on the corium, interiorly on the membrane. The fascia never acute or furcate at its extremities.

This variety is, in part, *N. variabilis*, var. *scutellaris*, Fieb.

Var. 3, *chavon*, nov. The preceding variety (2) but with clouded hemielytra.

This tendency to melanochroism increases (more particularly in Central and South American individuals) until a peculiar chequered (black and luteous, or dark red-brown and brunneo-testaceous) appearance is assumed; finally, some forms are entirely bluish-black or purple-brown (or both), excepting only a whitish or pale luteous fascia of varying width, on the clavus, this form being somewhat similar to *N. glauca*, var. *marginata* (*furcata*). This variety is *N. undulata*, var. *c.*, Say.

Var. 4, *punctata*, Fieb. The largest forms, with more prominent and quadrilateral eyes, bearing the same relation to ordinary *undulata* that *insulata*, var. *gealu* does to typical *insulata*, are (according to Prof. Uhler) *punctata*, Fieb. They vary in colour and pattern like the other forms. The alar nervures are golden-yellow; the abdominis dorsum varies from clear luteous to black; the venter varies from sordid-whitish to black (viâ whitish-blotched with black).

Long. (of vars. 1-4) 10.5-12 mm., lat. 3-4 mm.

Var. 5, *virescens*, Blanch., is indistinguishable save by the more minute size, from *N. undulata*, but it seems to be confined to Chili.

Long. 9-9.3 mm., lat. 3-3.2 mm.

Unfortunately the figure in the Atlas of Gay's work is not quite correct, either in structural details or in colouring. The antennæ in the figure represent those of an *Enithares*, while the body is unduly depressed, and the proportions inaccurate. There are two forms, in both of which the dorsum abdominis is black: (a) Concolorous luteous (*Paris Mus.*); (b) *hemielytra* black; clavus

(except the wide black sutural margin) and a small blotch on the corium, dirty white; apical portion of membrane, and a large spot about the middle of the apical margin of the corium, castaneous. *Scutellum* black (*Paris, Stockholm, and Vienna Mus.*; *Montandon's coll.*).

TYPES. *N. undulata*, Say, *punctata*, Fieb.? *N. virescens*, Blanch., *Paris Mus.*

*Hab.* N. and C. AMERICA; S. AMERICA, North of Patagonia. ANTILLES.

Var. 1. New Jersey and Maryland (my coll., *Prof. Uhler*), Guadeloupe (*Nouilhier and Montandon colls.*), Colombia (*Paris Mus.*).

Var. 2. Canada (*Provancher*), Winnipeg, Valley of Mackenzie River, etc. (*Uhler in litt.*); the whole of the U.S.A.; Mexico; St. Bartholomew, Jamaica; Cuba (*Paris Mus.*); Colombia, etc.

Var. 3. Most of the U.S.A., but local; Cuba; Mexico; Colombia (*Paris Mus.*); Peru (*Hamburg Mus.*).

Var. 4. Baltimore (*Fieber*), Sabillasville, nearly 2000 feet above sea level (my coll., *Prof. Uhler*), South States (*Uhler*); New Orleans (*Paris Mus.*).

Var. 5. Chili.

"This species inhabits the foulest pools, and in the dirty slush occasioned by the drainage of slaughter-houses, and in the slimy ponds attached to some of our brickyards, it revels as if in full enjoyment of the filth" (*Uhler*). *Prof. Uhler* also writes to me: "Water of high temperature (*i.e.*, exposed to the sun's continuous rays) gave me *N. undulata*, Say, in many conditions." (See also *N. insulata* for further notes.) This species is very similar to *N. glauca*, L., and it is difficult to differentiate them by words. *N. undulata* is always smaller and more triangular, and (though this is not always the case) the humeral margin does not seem to be so distinctly separated from the posterior margin of the pronotum as in *N. glauca*; the base of the pronotum thus acquires a more convexly curved and rounded appearance. The luteous examples of var. 3 are labelled in several collections "*noveboracensis*, Forst." There is, however, no *Notonecta noveboracensis*, Forst. *Gmelin* (1789, in *Linn. Syst. Nat.* xiii., p. 2119) by error substituted this name for *N. lineata*, Forst. (1771, *Nov. Spec. Ins.*, i.,

p. 70). From the description, the latter is evidently a *Corixa*, as, presumably, is also *N. noveboracensis*, Gmel.

The variations in *N. undulata* in the colour of the abdominis dorsum and venter are irrespective of hemielytral pattern and coloration; the variations in the colour of the scutellum are, to a certain extent, regular. Var. 1 has a luteous scutellum always; vars. 2 and 3 luteous, black, or variegated; vars. 4 and 5 only black; var. 6 luteous or black.

### 9. *Notonecta bifasciata*, Guér.

*Notonecta bifasciata*, Guér., 1835, Icon. R. Anim., p. 354.

*N. polystolisma*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 477; Berg., 1879, Ann. S. Cient. Argent., viii., p. 75 (reprint, p. 198).

*Head*: notocephalic lateral margins diverging curvedly from the narrow base, vertex about three times as wide as synthlipsis. *Pronotum*: humeral angles acute, accentuated, humeral margins sinuate, about subequal to lateral margin, posterior margin sinuate, width about two and one-seventh times as great as the length of the pronotum. Hemielytra varying much as in *N. undulata*. *Alar nervures* pale golden yellow. *Pedes*: intermediate tibial spur small. *Abdominis dorsum* black, genital segments testaceous. *Abdominis venter* castaneo-testaceous spotted with black.

Long. 8.6–9 mm., lat. 3–3.2 mm.

*TYPES*: *bifasciata*, Guérin-Ménéville colln. (*Mus. Paris*), *polystolisma*?

*Hab.* S. AMERICA. Apparently distributed over the greater part of Brazil, and the Argentine and Uruguayan Republics. I have given a very brief description of this species, as I am uncertain of its limits, and have had very little material to work on. Guérin's type (possessing violet-black hemielytra with a broad ivory-white band along the whole of the corial margin, and two orange spots near the apical margin of the corium) is stated by Guérin-Ménéville himself to be the same as *N. polystolisma*, Fieb., and accords well enough with the description. The type bears two written labels, the first and older, "Notonecta bifasciata, Guér., Ic. R. A. Plata

(type) Maldonado"; the second and newer, "Notonecta polystolisma, Fieb., p. 53, Maldonado bifasciata, Guér., Ic. R. A. (type)."

10. *Notonecta variabilis*, Fieb.

*Notonecta variabilis*, Fieb. (in part.), 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 477; Berg (in part.), 1879, Ann. S. Cient. Argent., viii., p. 74 (reprint, p. 197).

*Head*: as in *N. bifasciata*. *Pronotum*: width of posterior margin not quite twice as great as the length of the pronotum. *Hemelytra* very variable. *Alar* nervures pale golden yellow. *Pedes* and *abdomen* as in *N. undulata*, Say.

Long. 8.6-10 mm., lat. 3.2-3.7 mm.

TYPE. ?.

*Hab.* AMERICA. Apparently distributed over the greater part of the United States, Brazil, and the Argentine and Uruguayan Republics.

There are two well-marked forms, which may be distinct species. The first, which occurs more commonly in N. America (and is considered by Prof. Uhler to be a variety of *N. undulata*), is long and slender, approaching *N. uhleri* in shape both of head and hemelytra; the latter are usually whitish or yellowish immaculate. The second, which is found occasionally in N. America, but commonly in Uruguay and Argentine, is exceedingly like *N. undulata*, Say, both in appearance and hemelytral markings. It differs, however, in the shape of the head and generally in the much smaller size. It is the *N. variabilis*, Berg (according to specimens kindly lent to me by Mr. Distant). As regards the individual labelled "Type" in M. Noualhier's collection, I am unable to recognize it as the true type, although it may well act as one, inasmuch as it is apparently the only authentic specimen of Fieber's in existence. It is undoubtedly from Fieber's collection, having passed from Lethierry's possession to that of M. Noualhier. Nevertheless, Fieber (*l. c.*, p. 477) distinctly mentions the Vienna, Berlin, and Halle Museums as the collections wherein were his original specimens.

11. *Notonecta uhleri*, Kirk.

*Notonecta uhleri*, Kirk., 1897, Ann. Mag. N. H. (6), xx., p. 58.

*Head*: notocephalon in the form of an inverted wine-decanter, margins greatly curved, widely diverging towards the vertex, which is six to eight times wider than the synthlipsis, at which point the eyes are almost contiguous; breadth of the eye about ten times as great as that of the synthlipsis. *Pronotum*: humeral angles acute, accentuated, lateral margins sinuate, humeral margins little separate from the posterior margin. *Metanotum* dark purple-brown. *Hemelytra* varying from dark brick-red to rich orange-yellow; a large, irregular black blotch at the base of the corium extending transversely and non-acuminately from the apex of the clavus to the golden-yellow exocorial lateral submargin; membrane dark red-brown, apically black—this tint encroaching more or less basally. *Alar* nervures brown. *Pedes*: coxæ blackish; intermediate tibial spur blunt, subcylindrical. *Abdominis dorsum*: first and second segments rufotestaceous, deeper marginally, the remainder flavotestaceous, lurid marginally; this latter tint encroaching inwards more and more apically. *Abdominis venter* rufotestaceous, densely provided with greenish-black ciliæ.

Long. ♂. 11–11.4 mm., lat. 3.5–4 mm.; long. ♀, 12 mm., lat. 4 mm.

TYPE ♂. Uhler coll.

*Hab.* N. AMERICA, Massachusetts (*Uhler, Montandon, and Brit. Mus. colls.*), New Orleans (*Paris Mus.*), Florida (*Uhler coll.*).

Allied to *N. variabilis* (northern form) and probably representing the extreme limit of the *N. americana* series, viz.: *N. americana*, Fabr., *N. undulata*, Say, and *N. virescens*, Blanch., *N. bifasciata*, Guér., *N. variabilis*, Fieb., and *N. uhleri*, Kirk.

Easily separated from all the other *Notonectæ* by the structure of the head.

12. *Notonecta chinensis*, Fallou.

*Notonecta chinensis*, Fallou, 1887, Le Naturaliste, p. 413; Bergr., 1894, Rev. Ent., xiii., p. 164 (*redescription*).

*N. sinica*, Walk., 1873, Cat. Hem.-Het. Brit. Mus., viii., p. 204 (*nec Stål*), *syn. nov.*

*Head* very narrow at the base, from which the notocephalic lateral margins keep almost parallel for a little space, then slightly

diverge; vertex more than three times as wide as synthlipsis; breadth of the eye nearly five times as great as that of the synthlipsis. *Pronotum* and *scutellum* similar to those of *N. triguttata* (No. 13). *Hemelytra* varying from orange-red to red-brown, with an undulatory bluish-black fascia (occasionally represented by scattered spots) extending from suture to lateral margin, near the apical margin of the corium, but diverging from that as it approaches the lateral margin; membrane bluish-black. *Alar nervures* brown. *Abdominis dorsum* black, some of the middle segments being at times somewhat suffused with violet-brown. *Abdominis venter* black.

Long. 13.5–16.7 mm., lat. 5.2–6.2 mm.

TYPE. Fallou coll. (*Paris Mus.*).

*Hab.* CHINA: Peking, Kiang-Si,\* Se-Tchouen, Chen-Si (*Paris Mus.*), Kin-Kiang [?Chin-Kiang], Foo-Chan (*Brit. Mus.*), Fo-Kien (*Fallou and Bergroth colls.*), Ngan Hoi (*Montandon and my colls.*). Well distributed over the Chinese Empire.

To this species I have referred four specimens in the Paris Museum (from Chen-Si, Se-Tchouen, and Kiang-Si), which seem sufficiently distinct to bear a varietal name—*kiangsis*, var. nov.

*Hemelytra* sordid luteous with a dark-brown irregular mark extending in a zigzag from the apex of the clavus to the base of the membrane (along the suture), thence to the exocorial submargin and finally along the apical third of the latter. There is also a small dark-brown crescent on the exterior membrane lobe. Membrane rufoluteous.

Long. 14 mm., lat. 5 mm.

In *Ann. Mag. N. H.* (6), xx., p. 58, the type was referred to as being in the possession of Dr. Bergroth. That specimen was certainly from Fallou's collection and is that from which the redescription was drawn up by Dr. Bergroth. There is, however, an example from Fo-Kien in the Fallou collection (*Paris Museum*), labelled in Fallou's writing, "*Notonecta chinensis*. Type. Fallou, *Le Naturaliste*, 15, ii, 1887," so that this latter speci-

---

\* These names are given here as they were spelt on the labels, but it is difficult to identify some, as the same places are spelt differently in almost every atlas consulted.



men must be regarded as the type, Dr. Bergroth's example and the other individuals in Fallou's collection (*Paris Mus. and my coll.*) being entitled to rank as syntypes.

### 13. *Notonecta triguttata*, Motsch.

*Notonecta triguttata*, Motsch., 1861, *Études ent.*, x., p. 24.

*Head* wider at base than in *N. chinensis* and not so markedly divergent; notocephalic lateral margins sensibly curved and the vertex a trifle more than two and a-half times as wide as the synthlipsis, which is about a-third of the width of the eye. *Pronotum*: lateral and humeral margins sinuate, the former suddenly broadening towards the humeral angles (which are acute), the pronotum thus having somewhat the appearance of being subconstricted mediolaterally. *Hemelytra* variable in pattern, black or bluish-black, with three fasciæ or blotches, varying in size and extent, the anterior generally flavous, the postreme rufous or castaneous: the flavous bands sometimes widely separate and slender, causing melanochroic specimens, at other times uniting so that nearly the whole of the clavus and the anterior half of the corium form a single extensive blotch; the postreme spot situated along the apical margin of the corium. Lateral margins of exocorium and membrane narrowly flavescent. *Alar* nervures yellow-brown. *Pedes*: coxæ black. *Abdominis dorsum* black, occasionally slightly reddish-brown laterally. *Abdominis venter* black.

Long. 13-14 mm., lat. 5 mm.

TYPE. ? Moscow.

*Hab.* JAPAN, Yokohama (*Budapest, Noualhier and my colls.*), Seso (*Paris Mus.*).

Very common in Southern Japan.

Very similar at first sight to some forms of *N. glauca*, L., but readily distinguished by the cephalic structure.

### 14. *Notonecta montandoni*, Kirk.

*Notonecta montandoni*, Kirk., 1897, *Ann. Mag. N. H.*(6), xx., p. 56.

*Head*: very similar to that of *N. triguttata*, but altogether larger, wider both at the vertex and synthlipsis; notocephalic lateral margins much straighter; vertex about twice as wide as synthlipsis, which is about a-third of the breadth of an eye.

*Pronotum* much as in *N. triguttata*. *Hemelytra* dark crimson-lake, irregularly marked with black; as a rule, the membrane is entirely black; in some specimens there are scarcely any spots on the clavus and corium, in others a broad undulatory band runs across the corium; exocorium either entirely concolorous with the ground colour of the hemelytra, or blotched with black. *Alar* basal nervures crimson, the rest brown. *Pedes*: intermediate tibial spur very small. *Abdominis dorsum* black. *Abdominis venter* black, except the sordid testaceous (? green) connexivum.

Long. 16-16.7 mm., lat. 6 mm.

TYPE: Montandon colln.

*Hab.* CHINA: Kiang-Si (*Paris Mus.*), Ngan-Hoei (*Montandon and my collns.*), Mou Piu, Tibet (*Paris Mus.*).

Var. nov., *violacea*.

Slightly more robust than the type, notocephalon a little shorter, hemelytra immaculate violet, except the slightly infuscate exterior membrane lobe.

Long. 17.2 mm., lat. 7.5 mm.

TYPE. Montandon colln.

*Hab.* BURMA: "Catcin Cauri" (*Fea Ag. Nov.* 1886, *Montandon and my collns.*, *Hamburg Mus.*). In its entirety, therefore, *N. montandoni* varies in length from 16 to 17.2 mm., and in breadth from 6 to 7.5 mm.; its distribution embraces the major portion of the Chinese Empire (including Tibet) and Burma.

### 15. *Notonecta irrorata*, Uhl.

*Notonecta irrorata*, Uhl., 1878, Pr. Bost. N. H. Soc., xix., p. 443; 1886, Checkl., p. 28.

*N. ornata*, Fitch MS. (*Sign. coll.*).

*Head* small, notocephalic lateral margins diverging widely, vertex a little more than three times as wide as synthipsis; width of vertex and of the eye subequal; eyes rather larger proportionately than in *N. triguttata*, etc. *Pronotum* much wider basally than apically, lateral margins not sinuate, humeral angles acute, humeral and posterior margins sinuate. *Hemelytra* rich black, irrorated (especially on the clavus) with refulgent yellow-brown, interior lobe of membrane and apex of exterior lobe smoky. The irrorations vary greatly in different individuals; in some the corium and membrane are almost immaculate, in others the whole of the clavus and corium is irrorated, imparting a chequered appearance, while in others the clavus is rich (almost metallic) yellow-brown with

faint, distant, narrow black lines. *Alar nervures* brown. *Pedes* : intermediate tibial spur small. *Abdominis dorsum*: first to fifth segments black, sixth, seventh, and eighth sordid greyish-brown. *Abdominis venter* black.

Long. 13-14 mm., lat. 4-4.5 mm.

*Hab.* N. AMERICA.

Widely distributed throughout the United States of America, but local. Prof. Uhler writes me with regard to their occurrence in the environs of Baltimore, "Quite local and lives in shaded ponds of cool water. In this case the water came from springs that empty into old quarries of Phyllite slate, into which the roots of willows grow in thick mats and stain the water somewhat brown."

16. *Notonecta glauca*, L.

[Var. 1] *Notonecta glauca*, Linn., 1758, Syst. Nat., ed. x., p. 439; Fabr., 1794, Ent. Syst., iv., p. 57 (*type of genus*); Dougl. & Scott, 1865, Brit. Hem., i., p. 587, pl. xx., fig. 4.

*Nepa Notonecta*, de Geer, 1773, Mém., iii., p. 382, pl. xviii., figs. 16-28.

*Notonecta octopunctata*, Gmel., 1789, in Linn. Syst. Nat., ed. xiii., p. 2119, *syn. nov.*

*N. Fabricii*, var. *glauca*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 473.

*N. Fabrici*, var. *glauca*, Fieb., 1861, Europ. Hem., p. 101.

*N. glauca*, var. *fulva*, Maria, 1897, An. Soc. Españ., p. 130.

*N. secunda*, Schöff. [1766], Icon. Ins. Ratisb., i., pt. 1, pl. 97, fig. 1. *Excl. syn.*

[Var. 2] *N. marmorea*, Fabr., 1803, Syst. Rhyng., p. 103.

*N. prima*, Schöff. [1766], l. c., pl. 33, figs. 5 & 6. *Excl. syn.*

[Var. 3] *N. glauca*, var. nov. *canariensis*.

[Var. 4] *N. marginata*, Müll., 1776, Zool. Dan., p. 104.

*N. obliqua*, Thunb., 1787, DD. Ac. Mus. Upsal., p. 61, *syn. nov.*

*N. furcata*, Fabr., 1794, Ent. Syst., iv., p. 58; Coqueb., 1799, Illustr. Icon., i., p. 38, pl. 19, fig. 2; Haworth, 1812, Trans. Ent. Soc. Lond., i., 98.

- N. melanota*, Risso, 1826, Hist. princip. prod. Europ., p. 215.
- N. glauca* var. *furcata*, Saund., 1892, Hem.-Het. Brit. Isl., p. 328, pl. 31, fig. 2.
- [Var. 5] *N. maculata*, Fabr., 1794, Ent. Syst., iv., p. 58; Coqueb., *l. c.*, i., p. 38, pl. x., fig. 1; Curt., 1824, Brit. Ent., i., pl. x.; Herr.-Schäff., 1848, Wanz. Ins., viii., p. 23, pl. 256, fig. 797; Dougl. & Scott, 1865, Brit. Hem., i., p. 588.
- N. variegata*, Risso, 1826, *l. c.*, p. 215.
- N. umbrina*, Germar MS.
- N. Fabricii*, var. *umbrina*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 474.
- N. glauca*, var. *umbrina*, Put., 1880, Synops. Hem.-Het. France, p. 217.
- N. marmorea*, Frey-Gessn., 1891, MT. Schweiz. Ent. Ges., iii., p. 319 (*nec* Fabr.).

*Head* diverging slightly and curvedly from the base, curving slightly inwards towards the vertex, which is from two to two and a-quarter times as wide as the synthlipsis; the latter is about half the width of the eye. *Scutellum*, *metanotum*, and *hemielytra* very variable in colour; lobes of membrane subequal. *Alar nervures* variable in colour. *Pedes*: spur on intermediate tibiæ mediocre, apically black, rather blunt. *Abdominis dorsum* variable in colour. *Venter* black.

#### VARIETIES.

- 1 (8) *Scutellum* and *metanotum* black. *Abdominis dorsum* black (in immature specimens often pale violet-brown); genital segments often sordid greenish-white.
- 2 (3) *Alar nervures* brownish-black; *hemielytra* black or bluish-black, two diagonal luteous stripes on *clavus* and *corium*.  
3 *marginata*, Müll.
- 3 (2) *Alar nervures* brown or yellowish-brown:
- 4 (5) *Hemielytra* purple-black, irrorated with obscure castaneous.  
4 *canariensis*, Kirk.
- 5 (4) *Hemielytra* not purple-black.
- 6 (7) *Hemielytra* varying from greenish-yellow to yellow-brown, either almost immaculate or spotted and marked with brownish-black; *connexivum* black . . . 1 *glauca*, L.
- 7 (6) *Hemielytra* yellowish-brown marbled with darker and richer colour; *connexivum* dorsally greenish-testaceous.  
2 *marmorea*, Fabr.

- 8 (1) Scutellum black or luteous. Metanotum orange-yellow with a large blackish blotch close to the scutellar margins. Abdominal dorsal segments: first orange-yellow, second to fourth black (the fourth narrowly orange-yellow apically), fifth to eighth orange-yellow (the fifth basally blackish). Alar basal nervures orange-yellow.

*5 maculata*, Fabr.

Var. 1, *glauca*, L.

Hemelytra varying in colour from pale sage-green or stramineous to rich dark castaneous, either practically immaculate [when castaneous presumably var. *fulva*, Maria] or varyingly maculate with irregular blackish mottlings and spots. Alar nervures pale yellowish-brown.

I have taken small examples of this variety in brackish water near Gravesend (England) in company with marine Crustacea. From Maie-Nousky, Erzerum (*Vienna Mus.*), I have seen two specimens resembling in colour and disposition of the apical hemielytral fascia, the typical form of *N. americana*, Fabr.

Var. 2, *marmorea*, Fabr. (*glauca*, var.  $\beta$ , Leach).

Rich yellow-brown hemielytra with dark mottlings; connexivum greenish testaceous.

This var. has been confused with *maculata*, Fabr., and I have received a number of the latter labelled "marmorea," indeed, as regards the hemielytral pattern and coloration, some forms of each variety are quite indistinguishable from each other. This has been fully discussed in the *Revue d'Entomologie*, xvi., p. 222 (1897).

Var. 3, *marginata*, Müll. (*furcata*, auctt.).

Hemelytra bluish-black or dull black; clavus luteous except at the sutural margins; a longitudinal luteous fascia, varying in length, at the base of the endo- and mesocorium; in many individuals there are one or two ferruginous spots near the apical margin of the corium (*furcata*, var.  $\beta$ , Leach).

Among the intermediate forms between vars. 1, 2, and 3, may be mentioned:

(a) specimens from Sind Valley, Kashmir (*Budapest and Stockholm Mus.*).

Not unlike *N. irrorata*, Uhl., in hemielytral pattern, very pubescent, hemielytra dull black; clavus yellowish-brown or castaneous, mottled or faintly striped with blackish-brown, corium black obscurely irrorated with castaneous. Notocephalon a little wider at the base than in other forms.

( $\beta$ ) specimens from L. Kharak, Persia (*Paris Mus.*), and Transcaspia (*my coll.*), which are not unlike some forms of *N. insulata* in hemielytral pattern.

Clavus and basal half of corium luteotestaceous; exocorium, apical half of corium ferruginous, spotted and blotched with black.

Var. 4, *canariensis*, nov.

Notocephalon a trifle narrower than in the other forms. Hemielytra purple-black, obscurely irrorated with dark rich castaneous, margins of hemielytral areas narrowly the same colour; anterior half of exocorium rich castaneous blotched with black, posterior half black. Membrane black. Pedes rufotestaceous, suffused with rich green.

Resembling somewhat a very dark, elongate *N. irrorata*. By far the most ornate Notonectid I have seen.

Var. 5, *maculata*, Fabr.

Hemielytra orange-red or orange-yellow irrorated with brownish-red and blackish-brown, varying greatly in shade. Alar basal nervures orange-yellow, rest brown.

I have discussed this var. under var. *marmorata*.

A specimen from Barbary (*Paris Mus.*) is almost chocolate, while the hemielytra of one from Algiers (*Vienna Mus.*) are scarcely maculate.

In Fabricius's original description, the scutellum is said to be "album" which Herrich-Schäffer deems a misprint for "atrum;" there are, however, in the Paris Museum African examples (presently to be described) with luteous scutellum, and in any case it is a matter of no importance having regard to the variability of this feature in so many species. Through the kindness of Prof. Bouvier and Prof. Joanny Martin, I have been able to examine the type in the Bosc collection (*Paris Museum*) in which the scutellum is black. Under the name "var. *umbrina*"

Dr. Puton has had the kindness to send me specimens from Sicily, entirely according with the type above mentioned.

The forms with luteous scutellum have been labelled in several collections "*lutea*," but they differ by being darker and less robust and by the structural characters diagnostic of the two species (*vide* Analytical Table). They are (with the exception of the unguiculi, &c.) dark luteous as a rule, but in a few individuals, the hemielytra are incipiently brunneomaculate.

Long. 13·4 (12·2 exceptional)–17·2 mm., lat. 4·5–6 mm.; *glauca*, 13·4–16 mm., and 4·5–5·5 mm.; *marmorea*, 14·7–16 mm., and 5–5·5 mm.; *marginata*, 14–17·2 mm., and 5·2–6 mm.; *canariensis*, 14·5 mm.; and *maculata*, 12·2 (exceptional)–15 mm., and 5–5·5 mm.; *maculata* (leucochroic) 13·5–13·7 mm., and 4·6 mm.

TYPES: *glauca*, ? Upsala; *marmorea*, Mus. Sehestedt (*sec. Stål*); *Nepa notonecta*, Stockholm Mus. (*sec. Reuter*); *maculata*, Bosc coll. (*Paris Mus.*) [? "type"; rather "syntype"]; *canariensis*, Vienna Mus.; *marginata*?

*Hab.* EUROPE; ASIA, S. W. region, Siberia, N. India; AFRICA, palæarctic portion; CANARY ISLES.

*N. glauca* and *marmorea*; practically the whole of Europe, Amurland (*Brit. Mus.*), Transcaspia, Persia, Yarkand (*Distant*), and the whole of palæarctic Africa.

*N. marginata*: practically the whole of Europe (but rather local and apparently not a constant variety), Kashmir.

*N. canariensis*: Teneriffe, Barenco Nidalgo (*O. Simony*, 1888, *Vienna Mus.*).

*N. maculata*: the whole of Europe (but local) and palæarctic Africa; the leucochroic form seems confined to Africa.

In Pr. Ent. Soc. Lond., 1897, p. xxxv., I noted the presence of this species in North America. I was then under the impression that Prof. Uhler was responsible for the record of its occurrence in Michigan and Kansas (Townsend, 1891, Pr. Ent. Soc. Wash., ii., p. 56), but this appears to be a mistake, and it is probable that the specimens belong to *N. insulata*, while Shepherd's record (1848, Ann. Mag. N. H. (2), i., p. 158. Source of the Mississippi under 48°) applies to *N. insulata* or *N.*

*undulata*. Prof. Uhler writes that he has not seen any authentic examples from North America.

This species seems to be almost confined to stagnant water, though I have captured a single specimen in a running stream. This, however, appears to be unusual. It may be of interest to note here the colour changes after the final larval instar, which I have observed in two varieties, viz.: *glauca* and *marginata*.

In both, the imago leaves the ultimate larval skin, immaculate dead-white in colour. In the course of development, the hemielytra become pure ivory-white, while the scutellum early assumes a clear pale green colour, the golden-yellow pubescence being then noticeable. In *glauca*, the hemielytra very gradually change to their normal hue, the scutellum remaining greenish somewhat longer. In *marginata*, the hemielytra pass through the yellowish-green stages, then becoming pale purplish-brown, and thence to the final bluish-black, the abdominis dorsum passing through very similar stages. The claval and corial fasciæ, and the spots at the apical margin of the corium are ivory-white during the purplish-brown stage, the apical spots shortly turning yellowish and during the final development, the spots become castaneous and the fasciæ luteous.

#### 17. *Notonecta nigra*, Fieb.

*Notonecta nigra*, Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 473.

I have little to say upon this species; there appear to be only three specimens in collections, two in the Vienna Museum and one (labelled "Type," but upon which I can only offer an opinion similar to that on *N. variabilis*) in the collection of M. M. Noualhier. It appears structurally identical with *N. glauca*, and formerly, when I believed that *N. glauca* inhabited North America, it seemed probable that this was only a var. of that species.

Long. 16 mm., lat. 5.5 mm.

*Hab.* BRAZIL.

I have nothing further to add to Fieber's description.



18. *Notonecta lutea*, Müll.

*Notonecta lutea*, O. F. Müll., 1776, Zool. Dan., p. 103; Fieb., 1851, Abh. böhm. Ges. Wiss. (5), vii., p. 473; Flor, 1860, Rhynch. Livl., i., p. 774; Fieb., 1861, Europ. Hem., p. 100; J. Sahlb., 1875, Not. Sällsk. Faun. Fenn. Förh. xiv., p. 274; Duda, 1891, Klub. přírod. Praze, p. 13, pl. iv., fig. 1.

*N. unicolor*, Herr.-Schäff., 1835, Nomencl. Ent., p. 63; 1848, Wanz. Ins., viii., p. 23.

*N. tumida*, Germ. MS.

Head large, notocephalic lateral margins slightly diverging from base, vertex two to two and a-quarter times as wide as synthlipsis. Entirely luteous (except the dark claret eyes, occasional dark-brown markings along the sutures of the clavus, &c., the bronze-brown sternal hair-tufts, the black unguiculi and venter). *Scutellum* a third wider than long. Exterior lobe of *membrane* only about half the size of the interior lobe, and obviously not so long. *Alar* nervures luteous. *Pedes*: spine on intermediate tibia, large, acute, black-tipped.

Long. 13-17.1 mm., lat. pron. 4.5-5.5 mm.

TYPE lost. The description has been drawn up from specimens kindly sent by Dr. J. Sahlberg.

*Hab.* EUROPE, Tammati in Finland (*my coll.*), Bohemia (*my coll.*); ASIA, Siberia (*Brit. Mus.*).

Very similar in structure to *N. glauca*; it has, however, a more arched appearance, is stouter and more robust, especially postero-laterally, the apical margin of the pronotum is straighter and the scutellum is shorter. The intermediate tibial spur is also much longer. The head is larger and flatter, the notocephalon is rather wider basally and vertically, and the lateral margins straighter. Duda's figure represents a Bohemian specimen; these are generally less robust posteriorly than the northern forms. He has made the usual mistake of providing the posterior tarsi with long unguiculi.

Var. *scutellaris*, J. Sahlb.

Dr. Sahlberg has exhibited to the Societas Fennica some interesting varieties of this species, one of which he

has generously added to my collection. There is, in these, a decided reversion from leucochroism. The greater part of the apical margin (base *auctt.*) and the centre of the scutellum are dark brownish-black, and the hemielytra are much more marked (though rather obscurely) with brownish-black than the typical forms. It is most interesting that the membrane lobes of this var. are unequal, as in the type-forms.

*Hab.* FINLAND, Tammati (*Sahlb. coll.*) and Jaakkiina (*my coll.*)

#### UNRECOGNIZED SPECIES.

1. *N. alba*, Forskål, 1775, Descr. Anim. Orient., p. xxiii. Alexandria. ? *Anisops producta*.
2. *N. atomaria*, Pallas, 1771, Reise Russ. Reichs, i., p. 469; Gmel., 1789, in Linn. Syst. Nat. Ed., xiii., p. 2119. Volga at Novgorod. ? *Plea minutissima*.
3. *N. australis*, Ol., 1811, Encyc. Méth., viii., p. 389. Australia (*Bosc colln.*). ? *Anisops*.
4. *N. grisea*, Ol., 1811, l. c. San Domingo. ? *Anisops*; ? *N. undulata*.
5. *N. unifasciata*, Guér., 1858, Bull. Soc. Zool. Acclim., iv., p. 581. Mexico. ? *N. undulata*.

I had hoped to give an account in this paper of the metamorphoses of *N. glauca*, L. Unfortunately my attempts at rearing this species from the ova during two seasons have been only partially successful. I have, however, reared three larval instars from ova deposited in captivity, and am aware of two more, so that *Notonecta* has at least five larval instars. In the ultimate and perhaps also the penultimate larval stage, the species can always be determined by the structure of the head; in the first three, however, the shape of the head and eyes does not resemble the adult at all, but is more akin to that of *Corixa*, and the entire form of the insect in these stages is very different from that of the adult.

I hope to be able to give fuller particulars at a later date.